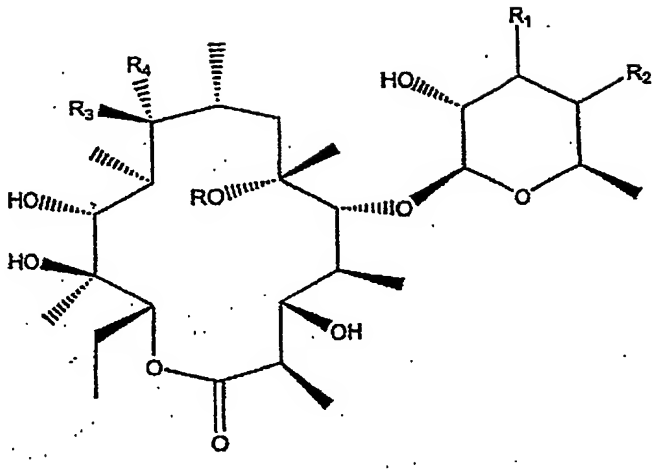
Claims

1. A compound of formula



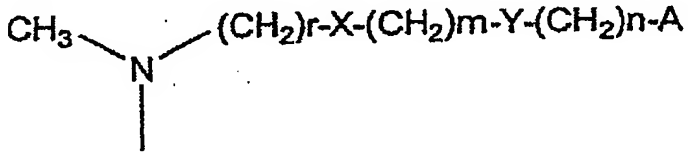
(I)

wherein

R is a hydrogen atom or a methyl group;

R_1 is a hydrogen atom, an N,N-di(C_1-C_3)alkylamino group, an N,N-di(C_1-C_3)alkylamino-N-oxide group, an N-(C_1-C_3)alkyl-N-benzylamino group, an N-(C_1-C_4)acyl-N-(C_1-C_3)alkylamino group, an N-[N,N-dimethylamino(C_1-C_4)alkylamino]acetyl-N-(C_1-C_3)alkylamino group

or a chain of formula



wherein

A is a hydrogen atom, a phenyl or a five- or six-membered heteroaryl ring having from one to three hetero atoms selected from nitrogen, oxygen and sulphur;

X is O, S, SO, SO_2 and NR_6, and R_6 is a hydrogen atom, a linear or branched C_1-C_3 alkyl, a C_1-C_3 alkoxycarbonyl group or a benzyloxycarbonyl group;

Y is a C_6H_4 group, a five- or six-membered heteroaryl ring having from one to three hetero atoms selected from nitrogen, oxygen and sulphur or is O, S, SO, SO_2 or NR_6 where R_6 has the meanings given above;

r is an integer from 1 to 3;

m is an integer from 1 to 6;

n is an integer from 0 to 2;

or R_1 forms a bond together with R_2;

R_2 is a hydrogen atom or forms a bond together with R_1;

R_3 is a hydroxy group or forms a group =N-O-R_5 together with R_4,

and R_5 is a hydrogen atom, a linear or branched C_1-C_5 alkyl, a benzyl optionally substituted with one or two substituents selected from nitro, hydroxy, carboxy, amino, linear or branched C_1-C_5 alkyl, C_1-C_4 alkoxycarbonyl groups, aminocarbonyl groups or cyano groups or a chain of formula

$$-(CH_2)r-X-(CH_2)m-Y-(CH_2)n-A$$

wherein

r, m, n, X, Y and A have the meanings given above;

~~R_4 is a hydrogen atom or forms a group =N-O-R_5 together with R_3,~~

and R_5 has the meanings given above;

and the pharmaceutically acceptable salts thereof,

~~provided, however, that R_1 is not a dimethylamino group when R_3 is hydroxy, and both R_2 and R_4 are a hydrogen atom.~~

2. A compound according to Claim 1, wherein the oxime group that may be present in position 9 is of E configuration.

3. A compound according to Claim 1, wherein R_1 is a hydrogen atom, an N-(C_1-C_3)alkyl-N-methylamino group, an N-(C_1-C_3)alkyl-N-

Provided, however, that

R_1 is not a dimethylamino group when R_3 is hydroxy, and both R_2 and R_4 are a hydrogen atom;

R_1 is not a dimethylamino group when in the substituent =N-O-R_5 in 9-position, R_5 is a hydrogen atom, a linear or branched C_1-C_5 alkyl, an unsubstituted benzyl group, or a chain -$(CH_2)_r$-X-$(CH_2)_m$-Y-$(CH_2)_n$-A where r is 1, X is O, m is 2, Y is O, n is 1, and A is H;

R_1 is not a methylethylamino group when in the substituent =N-O-R_5 in 9-position, R_5 is a linear or branched C_1-C_5 alkyl or an unsubstituted benzyl group;

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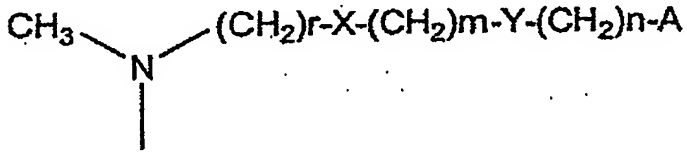
methylamino-N-oxide group, an N-benzyl-N-methylamino group, an N-(C_1-C_4)acyl-N-methylamino group, an N-[N,N-dimethylamino(C_1-C_4)alkylamino]acetyl-N-methylamino group or a chain of formula



wherein

A is a hydrogen atom, a phenyl or a five- or six-membered heteroaryl ring having from one to three hetero atoms selected from nitrogen, oxygen and sulphur;

X is O or NR_6 and R_6 is a hydrogen atom or a linear or branched C_1-C_3 alkyl;

Y, when n is 0, is a C_6H_4 group or a five- or six-membered heteroaryl ring having from one to three hetero atoms selected from nitrogen, oxygen and sulphur; or, when n is other than 0, is O or NR_6 and R_6 is a hydrogen atom or a linear or branched C_1-C_3 alkyl;

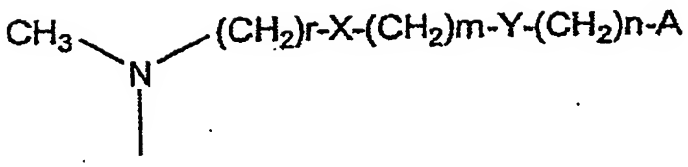
r is an integer from 1 to 3;

m is the integer 1 or 2;

n is an integer from 0 to 2;

or R_1 forms a bond together with R_2.

4. A compound according to Claim 3, wherein R_1 is a hydrogen atom, an N,N-dimethylamino-N-oxide group, an N-benzyl-N-methylamino group, an N-acetyl-N-methylamino group, an N-[N,N-dimethylamino(C_1-C_2)alkylamino]acetyl-N-methylamino group or a chain of formula



wherein

A is a hydrogen atom, a phenyl or a five- or six-membered heteroaryl ring selected from pyrrole, thiophene, furan, imidazole, oxazole, thiazole, pyridine, pyrimidine, triazole and thiadiazole;

X is O or NR_6 and R_6 is a hydrogen atom;

Y is, when n is 0, a C_6H_4 group or a five- or six-membered heteroaryl ring selected from pyrrole, thiophene, furan, imidazole, oxazole, thiazole, pyridine, pyrimidine, triazole and thiadiazole; or, when n is 1, NR_6 and R_6 is a hydrogen atom;

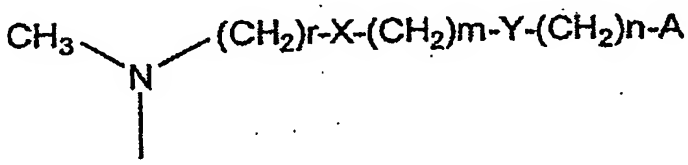
r is an integer from 1 to 3;

m is the integer 1 or 2;

n is the integer 0 or 1;

or R_1 forms a bond together with R_2.

5. A compound according to Claim 4, wherein R_1 is a hydrogen atom, an N,N-dimethylamino-N-oxide group, an N-benzyl-N-methylamino group, an N-acetyl-N-methylamino group, an N-[N,N-dimethylaminoethylamino]acetyl-N-methylamino group or a chain of formula



wherein

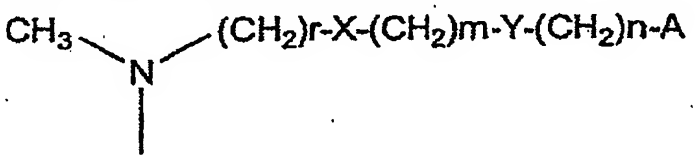
A is a hydrogen atom, a phenyl or a heteroaryl ring selected from thiophene, furan, thiazole, pyridine and triazole;

X is NR_6 and R_6 is a hydrogen atom;

Y is, when n is 0, a C_6H_4 group or a heteroaryl ring selected from thiophene, furan, thiazole, pyridine and triazole; or, when n is 1, NR_6 and R_6 is a hydrogen atom;
or R_1 forms a bond together with R_2.

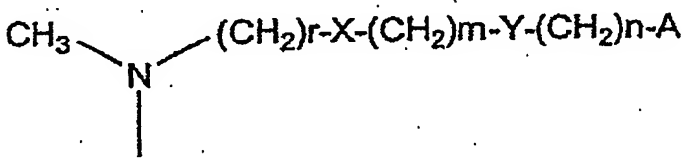
6. A compound according to Claim 1, wherein R_3 is a hydroxy group and R_4 is a hydrogen atom provided, however, that R1 is not a dimethylamino group.

7. A compound according to Claim 6, wherein R_1 is a hydrogen atom, an N-(C_1-C_3)alkyl-N-methylamino group, an N-(C_1-C_3)alkyl-N-methylamino-N-oxide group, an N-benzyl-N-methylamino group, an N-(C_1-C_4)acyl-N-methylamino group, an N-[N,N-dimethylamino(C_1-C_4)alkylamino]acetyl-N-methylamino group or a chain of formula



wherein
A is a hydrogen atom, a phenyl or a five- or six-memberedl heteroaryl ring having from one to three hetero atoms selected from nitrogen, oxygen and sulphur;
X is O or NR_6 and R_6 is a hydrogen atom or a linear or branched C_1-C_3 alkyl;
Y, when n is 0, is a C_6H_4 group or a five- or six-membered heteroaryl ring having from one to three hetero atoms selected from nitrogen, oxygen and sulphur; or, when n is other than 0, is O or NR_6 and R_6 is a hydrogen atom or a linear or branched C_1-C_3 alkyl;
r is an integer from 1 to 3;
m is the integer 1 or 2;
n is an integer from 0 to 2;
or R_1 forms a bond together with R_2.

8. A compound according to Claim 7, wherein R_1 is a hydrogen atom, an N,N-dimethylamino-N-oxide group, an N-benzyl-N-methylamino group, an N-acetyl-N-methylamino group, an N-[N,N-dimethylamino(C_1-C_2)alkylamino]acetyl-N-methylamino group or a chain of formula



wherein

A is a hydrogen atom, a phenyl or a five- or six-membered heteroaryl ring selected from pyrrole, thiophene, furan, imidazole, oxazole, thiazole, pyridine, pyrimidine, triazole and thiadiazole;

X is O or NR_6 and R_6 is a hydrogen atom;

Y is, when n is 0, a C_6H_4 group or a five- or six-membered heteroaryl ring selected from pyrrole, thiophene, furan, imidazole, oxazole, thiazole, pyridine, pyrimidine, triazole and thiadiazole; or, when n is 1, NR_6 and R_6 is a hydrogen atom;

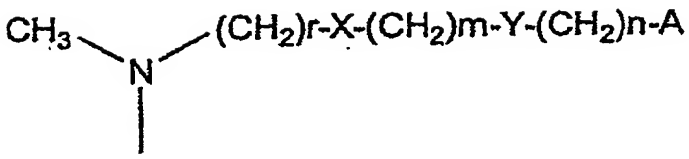
r is an integer from 1 to 3;

m is the integer 1 or 2;

n is the integer 0 or 1;

or R_1 forms a bond together with R_2.

9. A compound according to Claim 8, wherein R_1 is a hydrogen atom, an N,N-dimethylamino-N-oxide group, an N-benzyl-N-methylamino group, an N-acetyl-N-methylamino group, an N-[N,N-dimethylaminoethylamino]acetyl-N-methylamino group or a chain of formula



wherein

A is a hydrogen atom, a phenyl or a heteroaryl ring selected from thiophene, furan, thiazole, pyridine and triazole;

X is NR_6 and R_6 is a hydrogen atom;

Y is, when n is 0, a C_6H_4 group or a heteroaryl ring selected from thiophene, furan, thiazole, pyridine and triazole; or, when n is 1, NR_6 and R_6 is a hydrogen atom;

or R_1 forms a bond together with R_2.

10. A compound according to Claim 1, wherein R_3 forms an =N-O-R_5 group together with R_4, wherein R_5 is a hydrogen atom, a linear or branched (C_1-C_3)alkyl, a benzyl optionally substituted with one or two substituents selected from nitro, hydroxy, carboxy, amino, linear or branched (C_1-C_3) alkyl and cyano or a chain of formula

$$-(CH_2)r\text{-}X\text{-}(CH_2)m\text{-}Y\text{-}(CH_2)n\text{-}A$$

wherein

A is a hydrogen atom, a phenyl or a five- or six-membered heteroaryl ring having from one to three hetero atoms selected from nitrogen, oxygen and sulphur;

X is O or NR_6 and R_6 is a hydrogen atom or a linear or branched C_1-C_3 alkyl;

Y, when n is 0, is a C_6H_4 group or a five- or six-membered heteroaryl ring having from one to three hetero atoms selected from nitrogen, oxygen and sulphur; or, when n is other than 0, is O or NR_6 and R_6 is a hydrogen atom or a linear or branched C_1-C_3 alkyl;

r is the integer 1 or 2;

m is an integer from 1 to 6;

n is an integer from 0 to 2.

11. A compound according to Claim 10, wherein R_5 is a hydrogen atom, a methyl, a benzyl or a chain of formula

$$-(CH_2)r-X-(CH_2)m-Y-(CH_2)n-A$$

wherein

A is a hydrogen atom, a phenyl or a five- or six-membered heteroaryl ring selected from pyrrole, thiophene, furan, imidazole, oxazole, thiazole, pyridine, pyrimidine, triazole and thiadiazole;

X is O or NR_6 and R_6 is a hydrogen atom;

Y is, when n is 0, a C_6H_4 group or a five- or six-membered heteroaryl ring selected from pyrrole, thiophene, furan, imidazole, oxazole, thiazole, pyridine, pyrimidine, triazole and thiadiazole; or, when n is 1, NR_6 and R_6 is a hydrogen atom;

r is 2;

m is an integer from 1 to 6;

n is the integer 0 or 1.

12. A compound according to Claim 11, wherein R_5 is a hydrogen atom, a methyl, a benzyl or a chain of formula

$$-(CH_2)r-X-(CH_2)m-Y-(CH_2)n-A$$

wherein

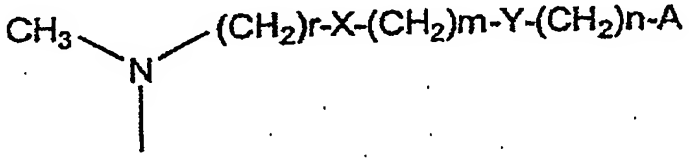
A is a hydrogen atom, a phenyl or a heteroaryl ring selected from thiophene, furan, thiazole, pyridine and triazole;

X is NR_6 and R_6 is a hydrogen atom;

Y is, when n is 0, a C_6H_4 group or a heteroaryl ring selected from thiophene, furan, thiazole, pyridine and triazole; or, when n is 1, NR_6 and R_6 is a hydrogen atom.

13. A compound according to Claim 1, wherein R_1 is a hydrogen atom, an N-(C_1-C_3)alkyl-N-methylamino group, an N-(C_1-C_3)alkyl-N-methylamino-N-oxide group, an N-benzyl-N-methylamino group, an

N-(C_1-C_4)acyl-N-methylamino group, an N-[N,N-dimethylamino(C_1-C_4)alkylamino]acetyl-N-methylamino group or a chain of formula



wherein

A is a hydrogen atom, a phenyl or a five- or six-membered heteroaryl ring selected from pyrrole, thiophene, furan, imidazole, oxazole, thiazole, pyridine, pyrimidine, triazole and thiadiazole;

X is O or NR_6 and R_6 is a hydrogen atom;

Y is, when n is 0, a C_6H_4 group or a five- or six-membered heteroaryl ring selected from pyrrole, thiophene, furan, imidazole, oxazole, thiazole, pyridine, pyrimidine, triazole and thiadiazole; or, when n is 1, NR_6 and R_6 is a hydrogen atom;

r is an integer from 1 to 3;

m is the integer 1 or 2;

n is the integer 0 or 1;

or R_1 forms a bond together with R_2;

simultaneously, R_3 forms a group =N-O-R_5 together with R_4,

wherein R_5 is a hydrogen atom, a linear or branched (C_1-C_3) alkyl, a benzyl optionally substituted with one or two substituents selected from nitro, hydroxy, carboxy, amino, linear or branched (C_1-C_3)alkyl and cyano or a chain of formula

$$-(CH_2)r\text{-}X\text{-}(CH_2)m\text{-}Y\text{-}(CH_2)n\text{-}A$$

wherein

A is a hydrogen atom, a phenyl or a five- or six-membered heteroaryl ring having from one to three hetero atoms selected from nitrogen, oxygen and sulphur;

X is O or NR_6 and R_6 is a hydrogen atom or a linear or branched C_1-C_3 alkyl;

Y, when n is 0, is a C_6H_4 group or a five- or six-membered heteroaryl ring having from one to three hetero atoms selected from nitrogen, oxygen and sulphur; or, when n is other than 0, is O or NR_6 and R_6 is a hydrogen atom or a linear or branched C_1-C_3 alkyl;

r is the integer 1 or 2;

m is an integer from 1 to 6;

n is an integer from 0 to 2.

14. A compound according to Claim 13, wherein R_5 is a hydrogen atom, a methyl, a benzyl or a chain of formula

$$-(CH_2)r-X-(CH_2)m-Y-(CH_2)n-A$$

wherein

A is a hydrogen atom, a phenyl or a five- or six-membered heteroaryl ring selected from pyrrole, thiophene, furan, imidazole, oxazole, thiazole, pyridine, pyrimidine, triazole and thiadiazole;

X is O or NR_6 and R_6 is a hydrogen atom;

Y is, when n is 0, a C_6H_4 group or a five- or six-membered heteroaryl ring selected from pyrrole, thiophene, furan, imidazole, oxazole, thiazole, pyridine, pyrimidine, triazole and thiadiazole; or, when n is 1, NR_6 and R_6 is a hydrogen atom;

r is 2;

m is an integer from 1 to 6;

n is the integer 0 or 1.

15. A compound according to Claim 14, wherein R_5 is a hydrogen atom, a methyl, a benzyl or a chain of formula

$$-(CH_2)r-X-(CH_2)m-Y-(CH_2)n-A$$

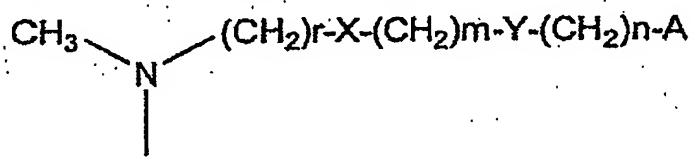
wherein

A is a hydrogen atom, a phenyl or a heteroaryl ring selected from thiophene, furan, thiazole, pyridine and triazole;

X is NR_6 and R_6 is a hydrogen atom;

Y is, when n is 0, a C_6H_4 group or a heteroaryl ring selected from thiophene, furan, thiazole, pyridine and triazole; or, when n is 1, NR_6 and R_6 is a hydrogen atom.

16. A compound according to Claim 15, wherein R_1 is a hydrogen atom, an N,N-dimethylamino group, an N,N-dimethylamino-N-oxide group, an N-benzyl-N-methylamino group, an N-acetyl-N-methylamino group, an N-[N,N-dimethylamino(C_1-C_2)alkylamino]acetyl-N-methylamino group or a chain of formula



wherein

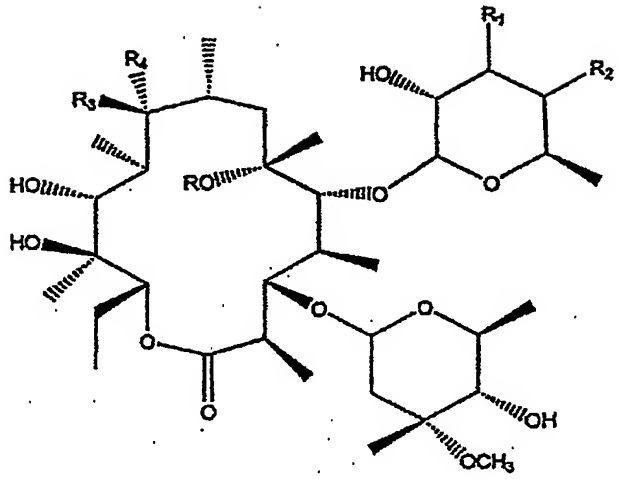
A is a hydrogen atom, a phenyl or a heteroaryl ring selected from thiophene, furan, thiazole, pyridine and triazole;

X is NR_6 and R_6 is a hydrogen atom;

Y is, when n is 0, a C_6H_4 group or a heteroaryl ring selected from thiophene, furan, thiazole, pyridine and triazole; or, when n is 1, NR_6 and R_6 is a hydrogen atom;

or R_1 forms a bond together with R_2.

17. A process for preparing a compound according to Claim 1, characterized in that the L-cladinose moiety in 3 position is removed from the erythromycin A compounds of formula



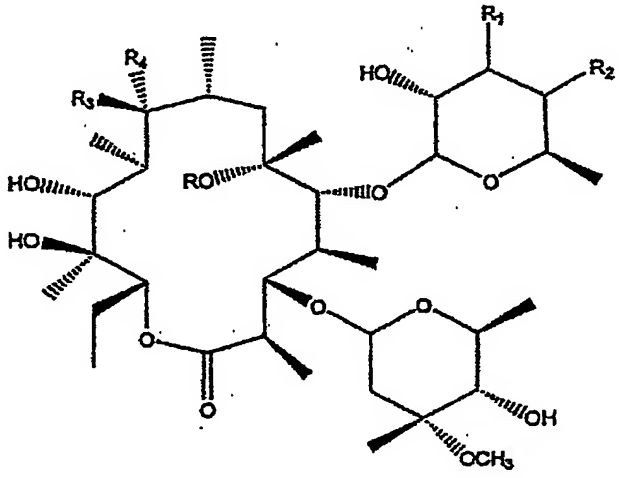
(II)

wherein R, R_1, R_2, R_3 and R_4 are defined as in Claim 1;
via a hydrolysis reaction.

18. Process according to Claim 17, wherein in formula II R_3 is a hydroxy group and R_4 is a hydrogen atom.

19. Process according to Claim 17, wherein the removal of the cladinose is performed via an acid hydrolysis reaction catalyzed in the presence of a mineral acid and a protic organic solvent.

20. A compound of formula



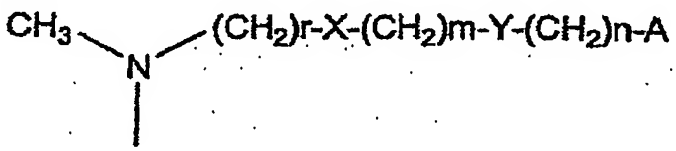
(II)

wherein

R is a hydrogen atom or a methyl group;

R_1 is a hydrogen atom, an N,N-di(C_1-C_3)alkylamino group, an N,N-di(C_1-C_3)alkylamino-N-oxide group, an N-(C_1-C_3)alkyl-N-benzylamino group, an N-(C_1-C_4)acyl-N-(C_1-C_3)alkylamino group, an N-[N,N-dimethylamino(C_1-C_4)alkylamino]acetyl-N-(C_1-C_3)alkylamino group

or a chain of formula



wherein

A is a hydrogen atom, a phenyl or a five- or six-membered heteroaryl ring having from one to three hetero atoms selected from nitrogen, oxygen and sulphur;

X is O, S, SO, SO_2 and NR_6, and R_6 is a hydrogen atom, a linear or branched C_1-C_3 alkyl, a C_1-C_3 alkoxycarbonyl group or a benzyloxycarbonyl group;

Y is a C_6H_4 group, a five- or six-membered heteroaryl ring having from one to three hetero atoms selected from nitrogen, oxygen and sulphur or is O, S, SO, SO_2 or NR_6 where R_6 has the meanings given above;

r is an integer from 1 to 3;

m is an integer from 1 to 6;

n is an integer from 0 to 2;

or R_1 forms a bond together with R_2;

R_2 is a hydrogen atom or forms a bond together with R_1;

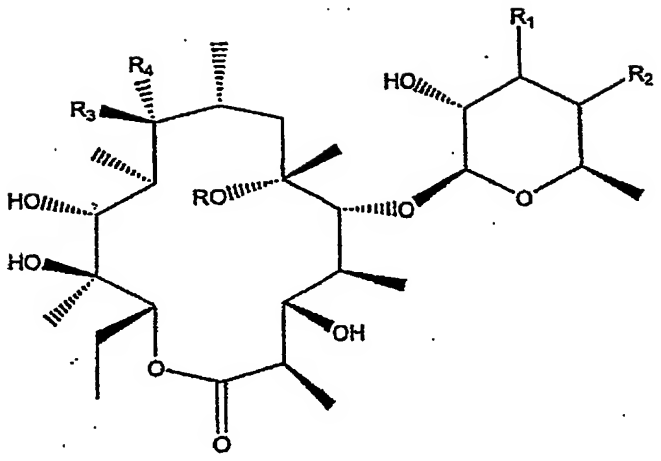
R_3 is a hydroxy group;

R_4 is a hydrogen atom;

and the pharmaceutically acceptable salts thereof;

provided, however, that (i) R_1 is not an N,N-dimethyl amino group, or (ii) R_1 is not an N,N-dimethyl amino-N-oxide group when R is a hydrogen atom.

21. A compound according to Claim 20, wherein R is a hydrogen atom and R_1 forms a bond together with R_2.
22. A compound according to Claim 20, wherein R is a hydrogen atom and R_1 is an N-benzyl-N-methylamino group.
23. A compound according to Claim 20, wherein R is a hydrogen atom and R_1 is an N-acetyl-N-methylamino group.
24. A compound according to Claim 20, wherein R is a hydrogen atom and R_1 is an N-[N,N-dimethylaminoethylamino]acetyl-N-methyl amino group.
25. A compound according to Claim 20, wherein R is a hydrogen atom and R_1 is an N-methyl-N-3-[(2-thiazolylmethyl)amino]propylamino group.
26. A compound according to Claim 20, wherein R is a hydrogen atom and R_1 is an N-2-[2-[(2-thiazolylmethyl)amino]ethylamino]ethyl-N-methylamino group.
27. A compound according to Claim 20, wherein R is a hydrogen atom and R_1 is an N-2-[2-(benzylamino)ethylamino]ethyl-N-methylamino group.
28. A compound of formula de(N-methyl)-9-dihydroerythromycin A.
29. A compound of formula de(N-methyl)-descladinosyl-9-dihydro-erythromycin A.
30. A pharmaceutical composition comprising a therapeutically effective amount of a compound of formula



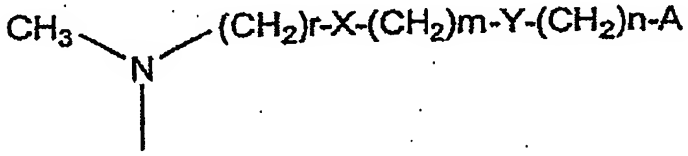
(I)

wherein

R is a hydrogen atom or a methyl group;

R_1 is a hydrogen atom, an N,N-di(C_1-C_3)alkylamino group, an N,N-di(C_1-C_3)alkylamino-N-oxide group, an N-(C_1-C_3)alkyl-N-benzylamino group, an N-(C_1-C_4)acyl-N-(C_1-C_3)alkylamino group, an N-[N,N-dimethylamino(C_1-C_4)alkylamino]acetyl-N-(C_1-C_3)alkylamino group

or a chain of formula



wherein

A is a hydrogen atom, a phenyl or a five- or six-membered heteroaryl ring having from one to three hetero atoms selected from nitrogen, oxygen and sulphur;

X is O, S, SO, SO_2 and NR_6, and R_6 is a hydrogen atom, a linear or branched C_1-C_3 alkyl, a C_1-C_3 alkoxycarbonyl group or a benzyloxycarbonyl group;

Y is a C_6H_4 group, a five- or six-membered heteroaryl ring having from one to three hetero atoms selected from nitrogen, oxygen and sulphur or is O, S, SO, SO_2 or NR_6 where R_6 has the meanings given above;

r is an integer from 1 to 3;

m is an integer from 1 to 6;

n is an integer from 0 to 2;

or R_1 forms a bond together with R_2;

R_2 is a hydrogen atom or forms a bond together with R_1;

R_3 is a hydroxy group or forms a group =N-O-R_5 together with R_4,

and R_5 is a hydrogen atom, a linear or branched C_1-C_5 alkyl, a benzyl optionally substituted with one or two substituents selected from nitro, hydroxy, carboxy, amino, linear or branched C_1-C_5 alkyl, C_1-C_4 alkoxycarbonyl groups, aminocarbonyl groups or cyano groups or a chain of formula

$$-(CH_2)r-X-(CH_2)m-Y-(CH_2)n-A$$

wherein

r, m, n, X, Y and A have the meanings given above;

R_4 is a hydrogen atom or forms a group =N-O-R_5 together with R_3;

and R_5 has the meanings given above;

or of a pharmaceutically acceptable salts thereof,

together with a pharmaceutically acceptable vehicle.

31. A pharmaceutical composition according to Claim 30 for use in treating inflammatory diseases.

32. A pharmaceutical composition according to Claim 30 for use in treating respiratory diseases.